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## BJR radiobiology special feature

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## RADIOBIOLOGY SPECIAL FEATURE: EDITORIAL

### BJR radiobiology special feature

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Radiobiology is the study of the action of ionizing radiations on living organisms and understanding it underpins the use of ionizing radiations in diagnostics and therapy in radiation oncology. The field is going through a period of rapid change and opportunity with new developments, feeding on the latest biology, driving a greater mechanistic understanding alongside advances in the clinical delivery of radiotherapy and diagnostic imaging.

This timely special issue encapsulates some key advances in radiobiology from the European Radiation Research Society, which held its annual meeting (ERR2013) at Dublin Castle, Dublin, Ireland 1–5 September 2013. International delegates, including scientists and clinicians, had the opportunity to hear the latest research in basic and translational radiation biology over 15 sessions of plenary and keynote lectures, proffered papers and posters. These sessions covered topics ranging from DNA damage and repair and non-ionizing radiation to translational research and emerging technologies.

This BJR special feature includes specially selected papers from all the keynote and award lectures presented at the meeting, giving a timely state-of-the-art overview of current research and future directions in radiation biology, from leaders in the field.

Professor Penny Jeggo<sup>1</sup> from the Genome Stability Unit at the University of Sussex (Brighton, UK) gave the *British Institute of Radiology Silvanus Thompson Memorial Lecture* at the meeting, and her review entitled “DNA DSB repair pathway choice: an orchestrated handover mechanism” gives a detailed molecular overview of the key mechanisms determining the choice of DNA repair pathway in response to radiation-induced DNA double-strand breaks.

The *European Radiation Research Society Bacq and Alexander Lecture* was given by Professor Marco Durante<sup>2</sup>, from the GSI Helmholtz Centre for Heavy Ion Research (Darmstadt, Germany) and his review focuses on new challenges in high-energy radiobiology. In particular, he reviews that densely ionizing radiation elicits signalling pathways quite distinct

from those involved in the cell and tissue response to photons. There are also differences in the role of the microenvironment in individual susceptibility and a need to focus more on tissue responses after ion-beam exposures.

The *Association for Radiation Research Weiss Medal Lecture* was given by Professor Stephanie McKeown<sup>3</sup> from the University of Ulster (Coleraine, UK) and covers the implications for treatment response of how we define normoxia, physoxia and hypoxia in tumours. Tumour hypoxia is increasingly recognized as a major deleterious factor in cancer therapies, as it compromises treatment and drives malignant progression. This review focuses on the need to determine the consequences of the actual physiological levels of oxygen in tissues (approximately 5%) and tumours (approximately 1%) to identify the real circumstances driving tumour response to treatment and/or malignant progression. This can be of particular importance in genetic studies *in vitro* when comparisons with human tumours are required.

Professor Jean-Luc Ravanat<sup>4</sup>, from CEA (Grenoble, France) gives a review of the chemical aspects of radiation-mediated formation of complex damage to DNA. In particular, he focuses on single oxidation events, as these lesions may play a significant role in cellular responses to ionizing radiation and other oxidative stress agents.

Professor David Brenner<sup>5</sup>, from Columbia University (New York, NY) gives a short overview of the inter-relationship between exposure doses, the use of radiological imaging techniques and the impact on radiation risk, which is an increasingly important area given the increasing contribution of medical exposures to the average background exposure doses for the population in general.

Professor Martin Brown<sup>6</sup>, Stanford University (Stanford, CA) gives an overview of the process of vasculogenesis, the formation of blood vessels from circulating cells, which is a crucial player in the resistance of solid tumours to radiotherapy. Radiation recruits proangiogenic macrophages, and endothelial progenitor cells reform the tumour vasculature and allow the tumour to regrow following irradiation. This

is a new paradigm with major implications for the treatment of solid tumours by radiotherapy.

The *LH Gray Memorial Trust Lecture* was given by Professor Rob Bristow<sup>7</sup> from the University of Toronto (Ontario, Canada). His review entitled “An arranged marriage for precision medicine: hypoxia and genomic assays in localized prostate cancer radiotherapy” focuses on the need to improve treatment individualization for prostate cancer patients receiving radiotherapy due to the 30–50% relapse rate. He outlines that better predictors of prognosis and radiotherapy treatment response are

needed to triage patients to bespoke and intensify calcium monophosphide treatment protocols. In particular, these should include the use of pre-treatment genomic tests based on DNA or RNA indices and/or assays that reflect cancer metabolism, such as hypoxia assays, to define patient-specific prostate cancer progression and aggression.

We hope that this collection of comprehensive review and opinion articles, from leaders in the field, sets the scene of where radiobiology research stands at present and outlines future progress.

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